MINIMAL HEARING LOSS AND READING IMPAIRMENT

- Is there a difference across reading skills with the association of minimal hearing loss and reading impairment?

- Do students with reading impairments exhibit minimal hearing loss among children with reading impairments. The current study aims to address the following research questions:

  1. Minimal hearing loss as a potential factor contributing to reading impairment in middle school students.
  2. Participants in the final sample will include 50 children in the middle school grades (4th to 8th grade), with 25 children diagnosed with a reading impairment and 25 controls.

  - Children complete a hearing exam to explore prevalence of minimal hearing loss. Next, children complete a battery of literacy and language measures in the areas of decoding, comprehension, word reading fluency, spelling, written expression, and writing fluency. The study aims to report the prevalence of minimal hearing loss in the population of children with reading impairments and explore whether there is a difference across reading skills with the association of minimal hearing loss and reading impairment. Implications of results will determine literacy instructional needs of children presenting with minimal hearing loss.

  2. The current project explores one potential factor contributing to reading impairments in children: minimal hearing loss. Minimal hearing loss is defined through several different diagnostic categories (Bess & Gravel, 2006). This project explores the prevalence of minimal hearing loss among children in a substantial percentage of students (Bess et al., 1998). By 9th grade, over half of children with minimal hearing loss have repeated a grade (Bess et al., 1998).

  - The current project explores one potential factor contributing to reading impairments: minimal hearing loss. Minimal hearing loss is defined through several different diagnostic categories (Bess & Gravel, 2006; Niskar et al., 1998): (a) permanent bilateral pure-tone averages (500, 1000, 2000 Hz) between 16 and 40 dB HL, (b) permanent unilateral hearing loss (normal hearing in one ear; pure-tone averages greater than 20 dB HL in affected ear), (c) unilateral or bilateral permanent high-frequency hearing loss (air conduction thresholds greater than 25 dB HL at two or more frequencies above 2000 Hz), and (d) permanent or temporary hearing loss due to fluid in the ears (e.g., because of an ear infection).

  3. The current project explored minimal hearing loss as a potential factor contributing to reading impairment in middle school students. Participants in the final sample will include 50 children in the middle school grades (4th to 8th grade), with 25 children diagnosed with a reading impairment and 25 controls. Children complete a hearing exam to explore prevalence of minimal hearing loss. Next, children complete a battery of literacy and language measures in the areas of decoding, comprehension, word reading fluency, spelling, written expression, and writing fluency. The study aims to report the prevalence of minimal hearing loss in the population of children with reading impairments and explore whether there is a difference across reading skills with the association of minimal hearing loss and reading impairment. Implications of results will determine literacy instructional needs of children presenting with minimal hearing loss.

4. **RESULTS**

   - **Hearing Screening**
     - Each child completed a hearing screening in a soundbooth. Thresholds were obtained at 500, 1000, 2000, 4000, 6000, and 8000 Hz. A child was classified to have failed if any threshold at the tested frequencies fell above 15 dB HL. The following table reports the results of the hearing screening by group:

<table>
<thead>
<tr>
<th>Group</th>
<th>Failed</th>
<th>Passed</th>
<th>% Failed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Reading</td>
<td>1</td>
<td>5</td>
<td>16.7%</td>
</tr>
<tr>
<td>Reading Impaired</td>
<td>5</td>
<td>4</td>
<td>55.6%</td>
</tr>
</tbody>
</table>

   - Over half of the reading impaired group (55.6%) failed the hearing screening, well above the fail rate in the normal reading group (16.7%). The children who failed the hearing screening are still classified as having normal hearing based on traditional definitions. Ear specific and bilateral pure-tone averages (PTA) fell within the normal range, tympanometry readings were normal, and anyone falling in high frequencies was limited to one frequency.

   - **The Simple View of Reading**
     - The Simple View of Reading model holds that overall reading comprehension ability is predicted by two components: decoding and comprehension. Decoding ability is measured at the word-level, defined as efficient word recognition. Comprehension ability is measured at the text-level, defined as using word level information to interpret sentences and discourse. The following table groups participants into categories defined by the Simple View of Reading Model:

     - Garden Variety Poor Readers: N=2
     - Poor Comprehenders: N=0
     - Normal Readers: N=6
     - Poor Decoders: N=7

   - All of the children in the reading impaired group had difficulties at the word level (decoding), with two also having difficulties at the text level (comprehension). Over half of the children in the reading impaired group failed the hearing screening, but they did not meet traditional diagnostic criteria for minimal hearing loss. Future studies should continue to explore the link between minimal hearing loss and specific reading skill abilities. Research should also focus on reevaluating traditional hearing screening practices and classification of minimal hearing loss. Dodd-Murphy et al. (2014) argued for screening at lower thresholds, and as we see in the results of this study, screening 15 dB HL may have potential for identifying contributing factors to reading impairments.

   - **ACKNOWLEDGEMENTS**
     - This study is the first author’s master’s thesis project. The larger research project is funded by a grant awarded to Dr. Werfel from the University of South Carolina Office of the Provost. We are thankful to the children who participated in the study and Logan Douglass, Emily Meteza, Addison Pound, and Breanna Todd for data collection and recruitment. No authors have any conflicts of interest to report.
     - Presented at 2017 SRCLD, Madison, WI
     - References available upon request.

   - **DISCUSSION**
     - All of the children in the reading impaired group had difficulties at the word level (decoding), with two also having difficulties at the text level (comprehension). Over half of the children in the reading impaired group failed the hearing screening, but they did not meet traditional diagnostic criteria for minimal hearing loss. Future studies should continue to explore the link between minimal hearing loss and specific reading skill abilities. Research should also focus on reevaluating traditional hearing screening practices and classification of minimal hearing loss. Dodd-Murphy et al. (2014) argued for screening at lower thresholds, and as we see in the results of this study, screening 15 dB HL may have potential for identifying contributing factors to reading impairments.

   - **METHOD**
     - Children were classified as having normal reading abilities, defined as Standard Scores above the 25th percentile on any assessment or subtest measuring reading skills. Seven children were classified as having poor decoding abilities, as measured by the WRMT–III and TOWRE-2. Two children were classified as being garden variety poor readers, having both poor word and text level abilities. No participants have shown difficulties in the area of comprehension alone.

   - **RESULTS**
     - The current project explored minimal hearing loss as a potential factor contributing to reading impairment in middle school students. Participants in the final sample will include 50 children in the middle school grades (4th to 8th grade), with 25 children diagnosed with a reading impairment and 25 controls. Children complete a hearing exam to explore prevalence of minimal hearing loss. Next, children complete a battery of literacy and language measures in the areas of decoding, comprehension, word reading fluency, spelling, written expression, and writing fluency. The study aims to report the prevalence of minimal hearing loss in the population of children with reading impairments and explore whether there is a difference across reading skills with the association of minimal hearing loss and reading impairment. Implications of results will determine literacy instructional needs of children presenting with minimal hearing loss.

   - **INTRODUCTION**
     - Reading impairment has long-term negative outcomes in academic, occupational, and social settings (Kutner et al., 2007), and minimal hearing loss appears to be associated with low reading achievement in a substantial percentage of students (Bess et al., 1998). By 9th grade, over half of children with minimal hearing loss have repeated a grade (Bess et al., 1998).

   - The current project explores one potential factor contributing to reading impairments in children: minimal hearing loss. Minimal hearing loss is defined through several different diagnostic categories (Bess & Gravel, 2006; Niskar et al., 1998): (a) permanent bilateral pure-tone averages (500, 1000, 2000 Hz) between 16 and 40 dB HL, (b) permanent unilateral hearing loss (normal hearing in one ear; pure-tone average greater than 20 dB HL in affected ear), (c) unilateral or bilateral permanent high-frequency hearing loss (air conduction thresholds greater than 25 dB HL at two or more frequencies above 2000 Hz), and (d) permanent or temporary hearing loss due to fluid in the ears (e.g., because of an ear infection).

   - **PURPOSE**
     - It is well established that moderate to profound hearing loss has an adverse effect on reading achievement (Moeller et al., 2007; Qi & Mitchell, 2012). The effect of minimal hearing loss on reading achievement is much less studied. To date, there is little research investigating the prevalence of minimal hearing loss among children with reading impairments. The current study aims to address the following research questions:

       - Do students with reading impairments exhibit minimal hearing loss at higher rates than students without reading impairments?
       - Is there a difference across reading skills with the association of minimal hearing loss and reading impairment?

   - Six children were classified as having normal reading abilities, defined as Standard Scores above the 25th percentile on any assessment or subtest measuring reading skills. Seven children were classified as having poor decoding abilities, as measured by the WRMT–III and TOWRE-2. Two children were classified as being garden variety poor readers, having both poor word and text level abilities. No participants have shown difficulties in the area of comprehension alone.